useful to solubilize heavier hydrocarbons that usually remain in the reservoir through primary drilling operations.

[009] For secondary and tertiary or enhanced oil recovery operations, it would be advantageous to employ a process that would enhance solubilization of oil to recover hydrocarbon-containing organic matter in the reservoir in a manner that is cost effective and that does not damage the reservoir. While effective methods and compositions exist for tertiary operations, current methods suffer due to expense of operations in comparison to the value of the produced hydrocarbon-containing organic matter.

SUMMARY OF ~~INVENTION~~DISCLOSURE

[0010] In accordance with one embodiment of the present ~~invention~~disclosure, a method of extracting hydrocarbon-containing organic matter from a hydrocarbon-containing material, includes the steps of providing a first liquid including a turpentine liquid and contacting the hydrocarbon-containing material with the turpentine liquid such that an extraction mixture is formed, as well as residual material. The extraction mixture contains at least a portion of the hydrocarbon-containing organic matter and the turpentine liquid. The residual material includes non-soluble material from the hydrocarbon-containing material. The residual material can also include a reduced portion of the hydrocarbon-containing organic matter in the circumstance where all such hydrocarbon-containing material has not been solubilized by the turpentine liquid and moved into the extraction mixture. The residual material is then separated from the extraction mixture. The extraction mixture is further separated into a first portion and a second portion. The first portion of the extraction mixture includes a hydrocarbon product stream that includes at least a

portion of the hydrocarbon-containing organic matter extracted from the hydrocarbon-containing material. The second portion of the extraction mixture includes at least a portion of the turpentine liquid. In one embodiment, at least a portion of the turpentine liquid is recycled to the hydrocarbon-extracting liquid.

[0011] In another embodiment, substantially all hydrocarbon-containing organic matter is extracted into the extraction mixture. In such embodiment, the residual materials are essentially oil-free and can be further used or disposed without impact to the environment.

[0011a] In a first aspect, there is provided a method of extracting hydrocarbon-containing organic matter from a hydrocarbon-containing material, comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

providing a substantially surfactant-free first liquid comprising a non-aqueous hydrocarbon-extracting liquid consisting essentially of a turpentine liquid selected from the group consisting of natural turpentine, synthetic turpentine, mineral turpentine, pine oil, α-pinene, β-pinene, α-terpineol, β-terpineol, γ-terpineol, terpene resins, α-terpene, β-terpene, γ-terpene, geraniol, 3-carene, dipentene (p-mentha-1,8-diene), nopol, pinane, 2-pinane hydroperoxide, terpin hydrate, 2-pinanol, dihydromycenol, isoborneol, p-menthan-8-ol, α-terpinyl acetate, citronellol, p-menthan-8-yl acetate, 7-hydroxydihydrocitronellal, menthol, anethole, camphene; p-cymene, anisaldeyde, 3,7-dimethyl-1,6-octadiene, isobornyl acetate, ocimene, alloocimene, alloocimene alcohols, 2-methoxy-2,6-dimethyl-7,8-epoxyoctane, camphor, citral, 7-methoxydihydro-citronellal, 10-camphorsulphonic acid, cintronellal, menthone, and mixtures thereof;

contacting the hydrocarbon-containing material with said hydrocarbon-extracting liquid such that an extraction mixture is formed, the extraction mixture comprising at least a portion of said hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid; and

separating the extraction mixture from any residual material containing non-soluble material from the hydrocarbon-containing material that is not soluble in the hydrocarbon-extracting liquid.

[0011b] In a second aspect, there is provided a method for recovering hydrocarbon-containing organic matter from tar sands, the method comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

obtaining tar sands comprising recoverable hydrocarbon-containing organic matter;

providing a substantially surfactant-free first liquid comprising a hydrocarbon-extracting liquid comprising a turpentine liquid comprising at least one of α-terpineol or β-terpineol;

supplying the tar sands sample to a contacting vessel, said contacting vessel comprising at least one inlet for supplying the hydrocarbon-extracting liquid;

contacting the tar sands sample with the hydrocarbon-extracting liquid in a contacting vessel and agitating the tar sands sample with the hydrocarbon-extracting liquid such that an extraction mixture is formed and a residual material is formed, the extraction mixture comprising at least a portion of the hydrocarbon-containing organic matter in the hydrocarbon-extracting liquid, the residual material comprising at least a portion of non-soluble material from the tar sands that is not soluble in the hydrocarbon-extracting liquid;

separating the extraction mixture from the residual material;

separating the extraction mixture into a hydrocarbon product stream and a hydrocarbon-extracting liquid stream, the hydrocarbon product stream comprising at least a portion of the hydrocarbon-containing organic matter from the tar sands; and

recycling at least a portion of the hydrocarbon-extracting liquid stream to the contacting step.

[0011c] In a third aspect, there is provided a method for recovering hydrocarbon-containing organic matter from comminuted hydrocarbon-containing oil shale, the method comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

providing the comminuted hydrocarbon-containing oil shale;

providing a substantially surfactant-free first liquid comprising a non-aqueous hydrocarbon-extracting liquid consisting essentially of a turpentine liquid selected from the group consisting of natural turpentine, synthetic turpentine, mineral turpentine, pine oil, α-pinene, β-pinene, α-terpineol, β-terpineol, γ-terpineol, terpene resins, α-terpene, β-terpene, γ-terpene, geraniol, 3-carene, dipentene (p-mentha-1,8-diene), nopol, pinane, 2-pinane hydroperoxide, terpin hydrate, 2-pinanol, dihydromycenol, isoborneol, p-menthan-8-ol, α-terpinyl acetate, citronellol, p-menthan-8-yl acetate, 7-hydroxydihydrocitronellal, menthol, anethole, camphene; p-cymene, anisaldeyde, 3,7-dimethyl-1,6-octadiene, isobornyl acetate, ocimene, alloocimene, alloocimene alcohols, 2-methoxy-2,6-dimethyl-7,8-epoxyoctane, camphor, citral, 7-methoxydihydro-citronellal, 10-camphorsulphonic acid, cintronellal, menthone, and mixtures thereof;

filtering the comminuted hydrocarbon-containing oil shale;

feeding the crushed hydrocarbon-containing oil shale to a contacting vessel, the contacting vessel comprising at least one inlet for supplying the hydrocarbon-extracting liquid to the contacting vessel;

contacting the comminuted hydrocarbon-containing oil shale with the hydrocarbon-extracting liquid such that an extraction mixture is formed and a residual material is formed, the extraction mixture comprising at least a portion of the hydrocarbon-containing organic matter in the hydrocarbon-extracting liquid, the residual material comprising at least a portion of non-soluble material from the oil shale that is not soluble in the hydrocarbon-extracting liquid

separating the extraction mixture from the residual material;

separating the hydrocarbon-containing organic matter from the hydrocarbon-extracting liquid in the extraction mixture to produce a hydrocarbon product stream and a hydrocarbon-extracting liquid stream, the hydrocarbon product stream comprising at least a portion of the hydrocarbon-containing organic matter from the comminuted hydrocarbon containing oil shale; and

recycling at least a portion of the hydrocarbon-extracting liquid stream to the contacting step.

[0011d] In a fourth aspect, there is provided a method for recovering hydrocarbon-containing organic matter from hydrocarbon-containing coal rich sub-surface formation, the method comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

obtaining coal, said coal comprising a recoverable hydrocarbon-containing organic matter;

grinding the coal to produce crushed coal ;

filtering the crushed coal ;

feeding the crushed coal to a contacting vessel, said contacting vessel comprising at least one inlet for supplying a hydrocarbon-extracting liquid to the contacting vessel;

contacting the crushed coal with a substantially surfactant-free non-aqueous hydrocarbon-extracting liquid consisting essentially of a turpentine liquid selected from the group consisting of natural turpentine, synthetic turpentine, mineral turpentine, pine oil, α-pinene, β–pinene, α-terpineol, β-terpineol, γ-terpineol, terpene resins, α-terpene, β-terpene, γ-terpene, geraniol, 3-carene, dipentene (p-mentha-1,8-diene), nopol, pinane, 2-pinane hydroperoxide, terpin hydrate, 2-pinanol, dihydromycenol, isoborneol, p-menthan-8-ol, α-terpinyl acetate, citronellol, p-menthan-8-yl acetate, 7-hydroxydihydrocitronellal, menthol, anethole, camaphene; p-cymene, anisaldeyde, 3,7-dimethyl-1,6-octadiene, isobornyl acetate, ocimene, alloocimene, alloocimene alcohols, 2-methoxy-2,6-dimethyl-7,8-epoxyoctane, camphor, citral, 7-methoxydihydro-citronellal, 10-camphorsulphonic acid, cintronellal, menthone, and mixtures thereof such that an extraction mixture is formed and a residual material is formed, the extraction mixture comprising at least a portion of the hydrocarbon-containing organic matter in the hydrocarbon-extracting liquid, the residual material comprising at least a portion of non-soluble material from the coal that is not soluble in the hydrocarbon-extracting liquid;

separating the residual material from the extraction mixture;

separating the hydrocarbon-containing organic matter from the hydrocarbon-extracting liquid to produce a hydrocarbon product stream and a hydrocarbon-

extracting liquid stream, the hydrocarbon product stream comprising at least a portion of the hydrocarbon-containing organic matter from the coal ; and

recycling at least a portion of the hydrocarbon-extracting liquid stream to the contacting step, wherein said first liquid contains no water or essentially no water.

[0011e] In a fifth aspect, there is provided a method for increasing recovery of hydrocarbon-containing organic matter from a production well coupled to a hydrocarbon-containing sub-surface formation, the subsurface formation comprising hydrocarbon-containing material, the method comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

providing an injection well, said injection being in fluid communication with the sub-surface formation;

providing a substantially surfactant-free first liquid comprising a non-aqueous hydrocarbon-extracting liquid consisting essentially of a turpentine liquid comprising terpineol;

injecting the hydrocarbon-extracting liquid through the injection well and into the formation, wherein the hydrocarbon-extracting liquid and the hydrocarbon-containing organic matter from the hydrocarbon containing sub-surface formation form an extraction mixture comprising at least a portion of the extraction mixture hydrocarbon-containing organic matter in at least a portion of the hydrocarbon-extracting liquid;

recovering the extraction mixture from the formation through the production well; and

separating the extraction mixture to produce a hydrocarbon product stream and a hydrocarbon-extracting liquid stream.

[0012] In another embodiment, the present ~~invention~~disclosure provides a method for reducing the rate of or inhibiting the corrosion of a corrodible surface or material. During transportation, drilling, downhole operations, exploration, hydrocarbon production, storage, or handling of hydrocarbon-containing material, for example by pipelines, tankers, casings, fishing tools, or drill bits, the metal surfaces that contact sulfur-containing compounds in the hydrocarbon containing materials may corrode. By reducing the corrosion rate of the corrodible surfaces, significant cost savings are realized.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Figure 1 is a schematic for one embodiment of an apparatus for the recovery of hydrocarbons from tar sands.

[0014] Figure 2 is a schematic for one embodiment of an apparatus for the recovery of hydrocarbons from oil shale.

[0015] Figure 3 is a schematic for one embodiment of an apparatus for the recovery of hydrocarbons from coal.

~~AMENDED~~ CLAIMS
~~received by the International Bureau on 13 July 2010 (13.07.10)~~

1. A method of extracting hydrocarbon-containing organic matter from a hydrocarbon-containing material, comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

providing a substantially surfactant-free first liquid comprising a non-aqueous hydrocarbon-extracting liquid consisting essentially of a turpentine liquid selected from the group consisting of natural turpentine, synthetic turpentine, mineral turpentine, pine oil, α-pinene, β-pinene, α-terpineol, β-terpineol, γ-terpineol, terpene resins, α-terpene, β-terpene, γ-terpene, geraniol, 3-carene, dipentene (p-mentha-1,8-diene), nopol, pinane, 2-pinane hydroperoxide, terpin hydrate, 2-pinanol, dihydromycenol, isoborneol, p-menthan-8-ol, α-terpinyl acetate, citronellol, p-menthan-8-yl acetate, 7-hydroxydihydrocitronellal, menthol, anethole, camphene; p-cymene, anisaldeyde, 3,7-dimethyl-1,6-octadiene, isobornyl acetate, ocimene, alloocimene, alloocimene alcohols, 2-methoxy-2,6-dimethyl-7,8-epoxyoctane, camphor, citral, 7-methoxydihydro-citronellal, 10-camphorsulphonic acid, cintronellal, menthone, and mixtures thereof;

contacting the hydrocarbon-containing material with said hydrocarbon-extracting liquid such that an extraction mixture is formed, the extraction mixture comprising at least a portion of said hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid; and

separating the extraction mixture from any residual material containing non-soluble material from the hydrocarbon-containing material that is not soluble in the hydrocarbon-extracting liquid.

2. The method of claim 1, further comprising the step of:

providing means for contacting said hydrocarbon-containing organic matter and said turpentine liquid in situ in an underground formation containing said

hydrocarbon–containing organic matter, and means for extracting said hydrocarbon-containing organic matter from said underground formation.

3. The method of claim 1, further comprising the step of:

separating the extraction mixture into a first portion and a second portion, the first portion of the extraction mixture comprising a hydrocarbon product comprising at least a portion of the hydrocarbon-containing organic matter, the second portion of the extraction mixture comprising at least a portion of the turpentine liquid.

4. The method of claim 3, further comprising the step of:

recycling at least a portion of the turpentine liquid to the hydrocarbon-extracting liquid for use in the contacting step.

5. The method of claim 3, wherein the extraction is performed at a site, and the separation is performed at or adjacent to the site of extraction.

6. The method of claim 3, wherein the extraction is performed at a site, and the separation is performed at a downstream facility distant from the site of extraction.

7. The method of claim 3, wherein the extraction is performed at a site, and the hydrocarbon-extracting liquid is partially separated from hydrocarbon-containing organic matter at or adjacent to the site of extraction.

8. The method of claim 2, wherein the hydrocarbon-containing material is in an underground formation and the contacting of the hydrocarbon-containing material with said turpentine liquid occurs in situ in the underground formation; and further comprising the step of:

recovering the extraction mixture through a production well in fluid communication with the underground formation, wherein the residual material remains in situ in the underground formation.

9. The method of claim 8 further comprising the step of injecting a hydrocarbon-extracting liquid stream into the underground formation for further extraction of hydrocarbon material.

10. The method of claim 1 wherein the turpentine liquid comprises at least about 30% by volume α-terpineol and at least about 15% β-terpineol.

11. The method of claim 1 wherein the turpentine liquid comprises at least about 50% by volume α-terpineol and at least about 20% by volume β-terpineol.

12. The method of claim 1 wherein the turpentine further comprises at least one of

α- terpene, β- terpene or γ-terpene.

13. The method of claim 1 wherein the turpentine liquid comprises α-terpineol and β-terpineol, wherein the ratio of α-terpineol to β-terpineol is at least about 1.3:1.

14. The method of claim 1 wherein the turpentine liquid comprises α-terpineol and β-terpineol, wherein the ratio of α-terpineol to β-terpineol is at least about 2:1.

15. The method of claim 1, wherein the turpentine liquid consists essentially of a mixture of α-terpineol, β-terpineol, α-terpene, and β-terpene.

16. The method of claim 1, wherein the turpentine liquid consists essentially of a mixture of α-terpineol, and β-terpineol.

17. The method of claim 1, wherein the first liquid consists essentially of a mixture of α-terpineol, β-terpineol, α-terpene, and β-terpene.

18. The method of claim 1, wherein the amount of organic matter extracted from the hydrocarbon-containing material is at least about 50%.

19. The method of claim 18, wherein the amount of organic matter extracted from the hydrocarbon-containing material is at least about 70%.

20. The method of claim 19, wherein the amount of organic matter extracted from the hydrocarbon-containing material is at least about 75%.

21. The method of claim 20, wherein the amount of organic matter extracted from the hydrocarbon-containing material is at least about 90%.

22. The method of claim 21, wherein the amount of organic matter extracted from the hydrocarbon-containing material is about 100%.

23. The method of claim 1, wherein at least about 80% of hydrocarbons present in said hydrocarbon-containing material extractable into said turpentine liquid, are extracted into said turpentine liquid within about 5 minutes of contacting said hydrocarbon-containing material with said first liquid.

24. The method of claim 1, wherein the amount of said turpentine liquid to any other turpentine-miscible solvent contained in said first liquid is at least about 1:1.

25. The method of claim 24, wherein the amount of said turpentine liquid to any other turpentine-miscible solvent contained in said first liquid is at least about 9:4.

26. The method of claim 25, wherein the amount of said turpentine liquid to any other turpentine-miscible solvent contained in said first liquid is at least about 3:1.

27. The method of claim 26, wherein the amount of said turpentine liquid to any other turpentine-miscible solvent contained in said first liquid is at least about 4:1.

28. The method of claim 1, wherein said first liquid consists essentially of said turpentine liquid.

29. The method of claim 1, wherein the hydrocarbon-containing material is contacted with said turpentine liquid in a ratio of at least about 2:1 of said turpentine liquid to said hydrocarbon-containing material.

30. The method of claim 1, wherein the hydrocarbon-containing material is a natural hydrocarbon-containing material from a naturally occurring geological formation containing at least one of coal, crude oil, extra heavy crude oil, tar, tar sands, oil shale, oil sands, natural gas, crude bitumen, natural kerogen, natural asphalt, or natural asphaltene.

31. The method of claim 30, wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 30 to 100% of hydrocarbon-containing organic matter originally contained within said natural hydrocarbon-containing material, extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 180 minutes of said contacting, at a contacting temperature in a range of from about 10 to 400°C, at a weight ratio of hydrocarbon-extracting liquid to the natural hydrocarbon-containing material of from about 10% to 600%.

32. The method of claim 30, wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 75 to 100% of hydrocarbon-containing organic matter originally contained within said natural hydrocarbon-containing material, extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 3 minutes of said contacting, at a contacting temperature in a range of from about 20 to 30°C, at a weight ratio of hydrocarbon-extracting liquid to the natural hydrocarbon-containing material of from about 1:1 to 2:1.

33. The method of claim 30, wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 85 to 100% of hydrocarbon-containing organic matter originally contained within said natural hydrocarbon-containing material, extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 3 minutes of said contacting, at a contacting temperature in a range of from about 20 to 30°C, at a weight ratio of hydrocarbon-extracting liquid to the natural hydrocarbon-containing material of from about 1:1 to 2:1.

34. The method of claim 31, wherein said hydrocarbon-containing material is coal, and wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 60 to 100% of hydrocarbon-containing organic matter originally contained within

said natural hydrocarbon-containing material extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 3 minutes of said contacting, at a contacting temperature in a range of from about 80 to 100°C, at a weight ratio of hydrocarbon-extracting liquid to said hydrocarbon-containing material of from about 1:1 to 2:1.

35. The method of claim 31, wherein said hydrocarbon-containing material is tar sands, and wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 85 to 100% of hydrocarbon-containing organic matter originally contained within said natural hydrocarbon-containing material, extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 3 minutes of said contacting, at a contacting temperature in a range of from about 30 to 60°C, at a weight ratio of hydrocarbon-extracting liquid to said hydrocarbon-containing material of from about 1:1 to 2:1.

36. The method of claim 31, wherein said hydrocarbon-containing material is oil shale, and wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 50 to 100% of hydrocarbon-containing organic matter originally contained within said natural hydrocarbon-containing material, extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 3 minutes of said contacting, at a contacting temperature in a range of from about 100 to 130°C, at a weight ratio of hydrocarbon-extracting liquid to said hydrocarbon-containing material of from about 1:1 to 2:1.

37. The method of claim 30, wherein said hydrocarbon-containing material is crude oil in an underground formation and the contacting of the crude oil with the hydrocarbon-extracting liquid occurs in situ in the underground formation, and wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 80 to 100% of hydrocarbon-containing organic matter originally contained within said natural

hydrocarbon-containing material, extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 3 minutes of said contacting, at a ratio of from about 1:1 to 1:2 of the hydrocarbon-extracting liquid to total pore volume of the underground formation .

38. The method of claim 30, wherein said hydrocarbon-containing material is extra heavy crude oil in an underground formation and the contacting of the crude oil with the hydrocarbon-extracting liquid occurs in situ in the underground formation, and wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 25 to 100% of hydrocarbon-containing organic matter originally contained within said natural hydrocarbon-containing material, extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 60 minutes of said contacting, at a ratio of from about 1:1 to 1:2 of the hydrocarbon-extracting liquid to total pore volume of the underground formation .

39. The method of claim 31, wherein said hydrocarbon-containing material is natural gas or petroleum gas, and wherein during said contacting, the hydrocarbon-containing organic matter extracted into the hydrocarbon-extracting liquid is in an amount that corresponds to an amount of from about 50 to 100% of hydrocarbon-containing organic matter originally contained within said natural hydrocarbon-containing material, extracted into the hydrocarbon-extracting liquid within from about 3 seconds to 60 minutes of said contacting, at a contacting temperature in a range of from about 10 to 300°C, at a weight ratio of hydrocarbon-extracting liquid to said hydrocarbon-containing material of from about 0.1 to 600%.

40. The method of claim 1 for extracting hydrocarbon-containing organic matter from a hydrocarbon-containing material, said hydrocarbon material comprising tar sands,

wherein the contacting of the hydrocarbon-containing material with said hydrocarbon-extracting liquid comprises the step of supplying the tar sands to an

interior portion of an extraction vessel and supplying the hydrocarbon-extracting liquid to the interior portion of the extraction vessel for a period of time operable to extract a substantial portion of the hydrocarbon-containing organic matter from the hydrocarbon-containing material.

41. The method of claim 1 for extracting hydrocarbon-containing organic matter from a hydrocarbon-containing material, said hydrocarbon material comprising oil shale, the method further comprising the step of:

grinding the hydrocarbon-containing organic matter to form a plurality of particles, the particles defining an average diameter size in the range of 4 mm to 25 mm such that the plurality of particles is contacting the hydrocarbon-extracting liquid.

42. The method of claim 1 for extracting hydrocarbon-containing organic matter from a hydrocarbon-containing material, said hydrocarbon material comprising coal, the method further comprising the step of:

grinding the hydrocarbon-containing organic matter to form a plurality of particles, the particles defining an average diameter size in the range of 0.01 mm to 1 mm such that the plurality of particles is contacting the hydrocarbon-extracting liquid.

43. A method for recovering hydrocarbon-containing organic matter from tar sands, the method comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

obtaining tar sands comprising recoverable hydrocarbon-containing organic matter;

providing a substantially surfactant-free first liquid comprising a hydrocarbon-extracting liquid comprising a turpentine liquid comprising at least one of α-terpineol or β-terpineol;

supplying the tar sands sample to a contacting vessel, said contacting vessel comprising at least one inlet for supplying the hydrocarbon-extracting liquid;

contacting the tar sands sample with the hydrocarbon-extracting liquid in a contacting vessel and agitating the tar sands sample with the hydrocarbon-extracting liquid such that an extraction mixture is formed and a residual material is formed, the extraction mixture comprising at least a portion of the hydrocarbon-containing organic matter in the hydrocarbon-extracting liquid, the residual material comprising at least a portion of non-soluble material from the tar sands that is not soluble in the hydrocarbon-extracting liquid;

separating the extraction mixture from the residual material;

separating the extraction mixture into a hydrocarbon product stream and a hydrocarbon-extracting liquid stream, the hydrocarbon product stream comprising at least a portion of the hydrocarbon-containing organic matter from the tar sands; and

recycling at least a portion of the hydrocarbon-extracting liquid stream to the contacting step.

44. A method for recovering hydrocarbon-containing organic matter from comminuted hydrocarbon-containing oil shale, the method comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

providing the comminuted hydrocarbon-containing oil shale;

providing a substantially surfactant-free first liquid comprising a non-aqueous hydrocarbon-extracting liquid consisting essentially of a turpentine liquid selected from the group consisting of natural turpentine, synthetic turpentine, mineral turpentine, pine oil, α-pinene, β-pinene, α-terpineol, β-terpineol, γ-terpineol, terpene resins, α-terpene, β-terpene, γ-terpene, geraniol, 3-carene, dipentene (p-mentha-1,8-diene), nopol, pinane, 2-pinane hydroperoxide, terpin hydrate, 2-pinanol, dihydromycenol, isoborneol, p-menthan-8-ol, α-terpinyl acetate,

citronellol, p-menthan-8-yl acetate, 7-hydroxydihydrocitronellal, menthol, anethole, camphene; p-cymene, anisaldeyde, 3,7-dimethyl-1,6-octadiene, isobornyl acetate, ocimene, alloocimene, alloocimene alcohols, 2-methoxy-2,6-dimethyl-7,8-epoxyoctane, camphor, citral, 7-methoxydihydro-citronellal, 10-camphorsulphonic acid, cintronellal, menthone, and mixtures thereof;

filtering the comminuted hydrocarbon-containing oil shale;

feeding the crushed hydrocarbon-containing oil shale to a contacting vessel, the contacting vessel comprising at least one inlet for supplying the hydrocarbon-extracting liquid to the contacting vessel;

contacting the comminuted hydrocarbon-containing oil shale with the hydrocarbon-extracting liquid such that an extraction mixture is formed and a residual material is formed, the extraction mixture comprising at least a portion of the hydrocarbon-containing organic matter in the hydrocarbon-extracting liquid, the residual material comprising at least a portion of non-soluble material from the oil shale that is not soluble in the hydrocarbon-extracting liquid

separating the extraction mixture from the residual material;

separating the hydrocarbon-containing organic matter from the hydrocarbon-extracting liquid in the extraction mixture to produce a hydrocarbon product stream and a hydrocarbon-extracting liquid stream, the hydrocarbon product stream comprising at least a portion of the hydrocarbon-containing organic matter from the comminuted hydrocarbon containing oil shale; and

recycling at least a portion of the hydrocarbon-extracting liquid stream to the contacting step.

45. A method for recovering hydrocarbon-containing organic matter from hydrocarbon-containing coal rich sub-surface formation, the method comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

obtaining coal, said coal comprising a recoverable hydrocarbon-containing organic matter;

grinding the coal to produce crushed coal ;

filtering the crushed coal ;

feeding the crushed coal to a contacting vessel, said contacting vessel comprising at least one inlet for supplying a hydrocarbon-extracting liquid to the contacting vessel;

contacting the crushed coal with a substantially surfactant-free non-aqueous hydrocarbon-extracting liquid consisting essentially of a turpentine liquid selected from the group consisting of natural turpentine, synthetic turpentine, mineral turpentine, pine oil, α-pinene, β-pinene, α-terpineol, β-terpineol, γ-terpineol, terpene resins, α-terpene, β-terpene, γ-terpene, geraniol, 3-carene, dipentene (p-mentha-1,8-diene), nopol, pinane, 2-pinane hydroperoxide, terpin hydrate, 2-pinanol, dihydromycenol, isoborneol, p-menthan-8-ol, α-terpinyl acetate, citronellol, p-menthan-8-yl acetate, 7-hydroxydihydrocitronellal, menthol, anethole, camphene; p-cymene, anisaldeyde, 3,7-dimethyl-1,6-octadiene, isobornyl acetate, ocimene, alloocimene, alloocimene alcohols, 2-methoxy-2,6-dimethyl-7,8-epoxyoctane, camphor, citral, 7-methoxydihydro-citronellal, 10-camphorsulphonic acid, cintronellal, menthone, and mixtures thereof such that an extraction mixture is formed and a residual material is formed, the extraction mixture comprising at least a portion of the hydrocarbon-containing organic matter in the hydrocarbon-extracting liquid, the residual material comprising at least a portion of non-soluble material from the coal that is not soluble in the hydrocarbon-extracting liquid;

separating the residual material from the extraction mixture;

separating the hydrocarbon-containing organic matter from the hydrocarbon-extracting liquid to produce a hydrocarbon product stream and a hydrocarbon-

extracting liquid stream, the hydrocarbon product stream comprising at least a portion of the hydrocarbon-containing organic matter from the coal ; and

recycling at least a portion of the hydrocarbon-extracting liquid stream to the contacting step, wherein said first liquid contains no water or essentially no water.

46. A method for increasing recovery of hydrocarbon-containing organic matter from a production well coupled to a hydrocarbon-containing sub-surface formation, the subsurface formation comprising hydrocarbon-containing material, the method comprising the steps of extracting the hydrocarbon-containing organic matter by a process consisting essentially of:

providing an injection well, said injection being in fluid communication with the sub-surface formation;

providing a substantially surfactant-free first liquid comprising a non-aqueous hydrocarbon-extracting liquid consisting essentially of a turpentine liquid comprising terpineol;

injecting the hydrocarbon-extracting liquid through the injection well and into the formation, wherein the hydrocarbon-extracting liquid and the hydrocarbon-containing organic matter from the hydrocarbon containing sub-surface formation form an extraction mixture comprising at least a portion of the extraction mixture hydrocarbon-containing organic matter in at least a portion of the hydrocarbon-extracting liquid;

recovering the extraction mixture from the formation through the production well; and

separating the extraction mixture to produce a hydrocarbon product stream and a hydrocarbon-extracting liquid stream.

47. The method of claim 46, wherein said contacting comprises mixing.

48. The method of claim 46, wherein said natural gas or petroleum gas is bubbled through said turpentine liquid.